PATENT ABSTRACTS OF JAPAN

(11)Publication number : 10-228914

(43)Date of publication of application : 25.08.1998

(51)Int.Cl. H01M 8/02

(21)Application number : 09-068888

(22)Date of filing : 13.02.1997

(71)Applicant : AISIN TAKAOKA LTD

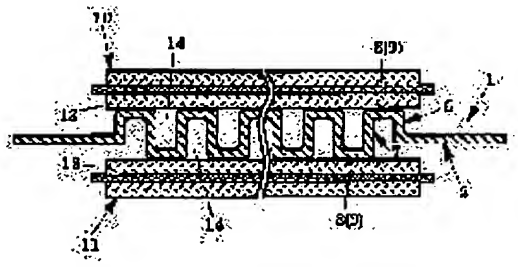
(72)Inventor : MATSUKAWA MASANORI

(54) SEPARATOR FOR FUEL CELL

(57)Abstract:

PROBLEM TO BE SOLVED: To obtain a separator for the fuel cell with small contact resistance with the unit cell electrode.

SOLUTION: Press forming the stainless steel (SUS304) into the corrugate formed part 7 with square-wavy forms in the internal circumference part 6, and the gold plated layer 9 with the thickness of 0.01-0.02μm is formed on the square-wavy top 8 of the corrugate formed part 7. In the case of forming a fuel cell, the fuel cell separator 1 is inserted between the layered unit cell 10, 11 and so arranged that the electrodes 12, 13 of the unit cells 10, 11 and the gold plated layer 9 formed on the square-wavy top 8 of the corrugate formed part 7 closely touch each other and the reaction gas passages 14 are formed between the fuel cell separator 1 and the electrodes 12, 13.



LEGAL STATUS

[Date of request for examination] 27.11.2003

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] The separator for fuel cells characterized by having consisted of a metal member and performing direct gold plate to the contact surface with the electrode of a unit cell.
[Claim 2] The separator for fuel cells according to claim 1 characterized by using this metal member as stainless steel.
[Claim 3] The separator for fuel cells according to claim 1 or 2 characterized by countering with this electrode and forming a reactant gas path.
[Claim 4] The separator for fuel cells according to claim 1 to 3 characterized by setting thickness of gold plate to 0.01-0.06 micrometers.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the small thing of the contact resistance of a separator and the electrode of a unit cell especially about the separator for fuel cells.
[0002]
[Description of the Prior Art] There are a polymer electrolyte fuel cell, a phosphoric acid mold fuel cell, a fused carbonate fuel cell, etc. in a fuel cell. The unit cell which produces electromotive force according to the electrochemical reaction of oxygen content gas and hydrogen content gas in these fuel cells, It has the separator which makes the operation which separates reactant gas while intervening between the unit cells by which this unit cell by which the laminating was carried out adjoins each other, contacting the electrode of both adjacent unit cell and connecting this both unit cell electrically. As this separator Substantia-compacta carbon material is used for a polymer electrolyte fuel cell and a phosphoric acid mold fuel cell, and the nickel/SUS clad plate is used for the fused carbonate fuel cell.
[0003]
[Problem(s) to be Solved by the Invention] However, the separator which used the separator and nickel/SUS clad plate which used these substantia-compacta carbon material has the trouble that contact resistance with the electrode of a unit cell is large. Then, this invention is made in order to cancel this trouble, and let it be a technical problem to offer the small separator for fuel cells of contact resistance with the electrode of a unit cell.
[0004]
[Means for Solving the Problem] The separator for fuel cells of the 1st invention consists of a metal member, and is characterized by performing direct gold plate to the contact surface with the electrode of a unit cell. The separator for fuel cells of the 2nd invention is characterized by using this metal member as stainless steel in the separator for fuel cells according to claim 1. The separator for fuel cells of the 3rd invention is characterized by countering with this electrode and forming a reactant gas path in the separator for fuel cells according to claim 1 or 2. The separator for fuel cells of the 4th invention is characterized by setting thickness of gold plate to 0.01-0.06 micrometers in the separator for fuel cells according to claim 1 to 3.
[0005] By performing direct gold plate to the contact surface with this electrode of this separator, the contact resistance of this separator and this electrode becomes small, and an electronic flow is performed good between this separator and this electrode.
[0006]
[Embodiment of the Invention] Although aluminum, titanium, nickel-iron alloy, stainless steel, etc. can be used for a metal member, it is desirable to use stainless steel from a viewpoint of corrosion resistance. Although the reactant gas path formed between a separator and an electrode may form and form a slot to an electrode and irregularity may be prepared and formed to a separator, when

especially an electrode is a product made from carbon, it is desirable to prepare metal separator irregularity and to form a reactant gas path. Although the thickness of the gold plate performed to a separator is not restricted, since it became clear that contact resistance becomes especially small and does not have generating of a pinhole, either, when this thickness is set to 0.01-0.06 micrometers as a result of the experiment, as for the thickness of this gold plate, it is desirable to be referred to as 0.01-0.06 micrometers. This separator is employable as various fuel cells, such as a polymer electrolyte fuel cell, a phosphoric acid mold fuel cell, and a fused carbonate fuel cell.

[0007]

[Example] Hereafter, the separator for fuel cells adopted as a polymer electrolyte fuel cell is explained as an example of this invention based on drawing 1 -5. As shown in drawing 1 , the separator 1 for fuel cells of this example is what used stainless steel (SUS304), the circulation hole 3 for reactant gas installation, the circulation hole 4 for a reactant gas outflow, and the cooling water circulation hole 5 are drilled in the periphery section 2, and the bulge shaping section 7 which consists of many irregularity by press forming is formed in the inner circumference section 6. The gold plate layer 9 with a thickness of 0.01-0.02 micrometers is formed in the bulge tip side edge side 8 of the bulge shaping section 7. As shown in drawing 2 , in case a fuel cell is formed, a separator 1 intervenes among the unit cells 10 and 11 by which the laminating was carried out, it is arranged so that the electrodes 12 and 13 of the unit cells 10 and 11 and the gold plate layer 9 formed in the bulge tip side edge side 8 of the bulge shaping section 7 may contact, and forms the reactant gas path 14 between a separator 1 and an electrode 12.

[0008] The gold plate layer 9 of a separator 1 carried out and formed the washing process, the parcel-gilding stroke, the washing process, and the desiccation process in this sequence the cleaning process, a washing process, and surface activity chemically-modified degree, without performing substrate plating to the separator material by which press forming was carried out. At a cleaning process, the fats and oils which adhered to the front face of a separator material using the strong-base system degreaser are removed. To a surface activity chemically-modified degree, using an inorganic mixing acid and an organic system inhibitor as a processing agent, while activating the front face of a separator material, it graduates. In a parcel-gilding stroke, parcel plating is carried out to the bulge tip side edge side 8 of the bulge shaping section 7 of a separator material using the sparger method which blows off plating processing liquid from the nozzle which impressed the electrical potential difference to the separator material in the plated section, and forms a partial deposit, using a cyanogen golden potassium solution as plating processing liquid.

[0009] In order to investigate the effect of the gold plate layer 9 exerted on the contact resistance of a separator 1 and the electrodes 12 and 13 of the unit cells 10 and 11, as shown in drawing 3 , the flow resistance at the time of an electron flowing in a separator 17 through an electrode substrate 16 from a separator 15 was measured. Hereafter, it explains in full detail about measurement of flow resistance. As shown in drawing 3 , the electrode substrate 16 which consists of the same component as the electrodes 12 and 13 of the unit cells 10 and 11 is pinched between the separators 15 and separators 17 which consist of the same structure and the same quality of the material as a separator 1. Furthermore, a separator 15 and a separator 17 are pinched with the collecting electrode plates 19 and 20 of a pair linked to a constant current power supply 18. When a fixed current is supplied between a separator 15 and 17, a separator 15 and the potentiometer 21 by which series connection was carried out among 17 detect a separator 15 and the potential difference produced among 17, this potential difference is converted into resistance, and flow resistance is acquired. Under the present circumstances, collecting electrode plates 19 and 20 are grasped with the press plates 24 and 25 through electric insulating plates 22 and 23, the press plates 24 and 25 are pressed with press equipment (not shown), and the planar pressure of predetermined magnitude is applied to the bulge tip side edge sides 26 and 27 of separators 15 and 17.

[0010] The thickness of the gold plate layers 28 and 29 formed in the bulge tip side edge sides 26

and 27 of the separators 15 and 17 under fixed planar pressure at drawing 4 and relation with flow resistance are shown. when flow resistance became small and became smaller than 0.06 micrometers so that from drawing 4 R> 4, and the thickness of the gold plate layers 28 and 29 became thin, it became clear to become flow resistance of about 1 law.

[0011] The relation (the inside of drawing, a "example", and publication) between the flow resistance at the time of changing the planar pressure applied to the bulge tip side edge sides 26 and 27 of separators 15 and 17 to drawing 5 and planar pressure is shown. The separator made from substantia-compacta carbon and the separator made from a nickel/SUS clad plate are produced for a comparison. Replace with separators 15 and 17 and an electrode substrate 16 is pinched with the separator made from substantia-compacta carbon. Relation between the flow resistance at the time of changing planar pressure and measuring flow resistance, and planar pressure (among drawing) It replaces with "the example 1 of a comparison", a publication, and separators 15 and 17, an electrode substrate 16 is pinched with the separator made from a nickel/SUS clad plate, and the relation (the inside of drawing, the "example 2 of a comparison", and publication) between the flow resistance at the time of changing planar pressure and measuring flow resistance and planar pressure is written together to drawing 5 , respectively. In addition, also in which separator, the touch area on appearance with an electrode substrate 16 is the same.

[0012] Although separators 15 and 17, the separator made from substantia-compacta carbon, and the separator made from a nickel/SUS clad plate of the inclination for flow resistance to fall, so that planar pressure becomes large were the same so that clearly from drawing 5 , the magnitude of the flow resistance to fixed planar pressure had the smallest separators 15 and 17.

[0013] In order to investigate the corrosion resistance of a separator 1, the nitric-acid aeration trial (JIS H8621) was carried out and it checked whether the pinhole used as the origin of corrosion would exist in the gold plate layer 9. Consequently, as for the elution of Cr, the thickness of the gold plate layer 9 was not observed by 0.01 micrometers or more, but it has checked that the pinhole was not formed.

[0014]

[Effect of the Invention] Since according to the 1st invention the separator for fuel cells was formed by the metal member, direct gold plate was performed to the contact surface with the electrode of a unit cell, the contact resistance of this separator and this electrode falls and the flow of the electron to this electrode becomes good from this separator, the output voltage of a fuel cell becomes large. Since according to the 2nd invention this metal member was used as stainless steel and corrosion resistance becomes good, endurance improves. Since according to the 3rd invention this separator meets this electrode, and forms the path of reactant gas and it becomes possible to form a reactant gas path with the easy metal separator of shaping, the productivity of a fuel cell improves. Since thickness of gold plate was set to 0.01-0.06 micrometers, while according to the 4th invention the contact resistance of the separator for fuel cells and the electrode of a unit cell becomes still smaller and the output voltage of a fuel cell improves, a cost cut is attained, in order that there may be little amount of the gold used per this separator and it may end.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

TECHNICAL FIELD

[Field of the Invention] This invention relates to the small thing of the contact resistance of a separator and the electrode of a unit cell especially about the separator for fuel cells.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

PRIOR ART

[Description of the Prior Art] There are a polymer electrolyte fuel cell, a phosphoric acid mold fuel cell, a fused carbonate fuel cell, etc. in a fuel cell. The unit cell which produces electromotive force according to the electrochemical reaction of oxygen content gas and hydrogen content gas in these fuel cells, It has the separator which makes the operation which separates reactant gas while intervening between the unit cells by which this unit cell by which the laminating was carried out adjoins each other, contacting the electrode of both adjacent unit cell and connecting this both unit cell electrically. As this separator Substantia-compacta carbon material is used for a polymer electrolyte fuel cell and a phosphoric acid mold fuel cell, and the nickel/SUS clad plate is used for the fused carbonate fuel cell.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

EFFECT OF THE INVENTION

[Effect of the Invention] Since according to the 1st invention the separator for fuel cells was formed by the metal member, direct gold plate was performed to the contact surface with the electrode of a unit cell, the contact resistance of this separator and this electrode falls and the flow of the electron to this electrode becomes good from this separator, the output voltage of a fuel cell becomes large. Since according to the 2nd invention this metal member was used as stainless steel and corrosion resistance becomes good, endurance improves. Since according to the 3rd invention this separator meets this electrode, and forms the path of reactant gas and it becomes possible to form a reactant gas path with the easy metal separator of shaping, the productivity of a fuel cell improves. Since thickness of gold plate was set to 0.01-0.06 micrometers, while according to the 4th invention the contact resistance of the separator for fuel cells and the electrode of a unit cell becomes still smaller and the output voltage of a fuel cell improves, a cost cut is attained, in order that there may be little amount of the gold used per this separator and it may end.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, the separator which used the separator and nickel/SUS clad plate which used these substantia-compacta carbon material has the trouble that contact resistance with the electrode of a unit cell is large. Then, this invention is made in order to cancel this trouble, and let it be a technical problem to offer the small separator for fuel cells of contact resistance with the electrode of a unit cell.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

MEANS

[Means for Solving the Problem] The separator for fuel cells of the 1st invention consists of a metal member, and is characterized by performing direct gold plate to the contact surface with the electrode of a unit cell. The separator for fuel cells of the 2nd invention is characterized by using this metal member as stainless steel in the separator for fuel cells according to claim 1. The separator for fuel cells of the 3rd invention is characterized by countering with this electrode and forming a reactant gas path in the separator for fuel cells according to claim 1 or 2. The separator for fuel cells of the 4th invention is characterized by setting thickness of gold plate to 0.01-0.06 micrometers in the separator for fuel cells according to claim 1 to 3.
[0005] By performing direct gold plate to the contact surface with this electrode of this separator, the contact resistance of this separator and this electrode becomes small, and an electronic flow is performed good between this separator and this electrode.
[0006]
[Embodiment of the Invention] Although aluminum, titanium, nickel-iron alloy, stainless steel, etc. can be used for a metal member, it is desirable to use stainless steel from a viewpoint of corrosion resistance. Although the reactant gas path formed between a separator and an electrode may form and form a slot to an electrode and irregularity may be prepared and formed to a separator, when especially an electrode is a product made from carbon, it is desirable to prepare metal separator irregularity and to form a reactant gas path. Although the thickness of the gold plate performed to a separator is not restricted, since it became clear that contact resistance becomes especially small and does not have generating of a pinhole, either, when this thickness is set to 0.01-0.06 micrometers as a result of the experiment, as for the thickness of this gold plate, it is desirable to be referred to as 0.01-0.06 micrometers. This separator is employable as various fuel cells, such as a polymer electrolyte fuel cell, a phosphoric acid mold fuel cell, and a fused carbonate fuel cell.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

EXAMPLE

[Example] Hereafter, the separator for fuel cells adopted as a polymer electrolyte fuel cell is explained as an example of this invention based on drawing 1 -5. As shown in drawing 1 , the separator 1 for fuel cells of this example is what used stainless steel (SUS304), the circulation hole 3 for reactant gas installation, the circulation hole 4 for a reactant gas outflow, and the cooling water circulation hole 5 are drilled in the periphery section 2, and the bulge shaping section 7 which consists of many irregularity by press forming is formed in the inner circumference section 6. The gold plate layer 9 with a thickness of 0.01-0.02 micrometers is formed in the bulge tip side edge side 8 of the bulge shaping section 7. As shown in drawing 2 , in case a fuel cell is formed, a separator 1 intervenes among the unit cells 10 and 11 by which the laminating was carried out, it is arranged so that the electrodes 12 and 13 of the unit cells 10 and 11 and the gold plate layer 9 formed in the bulge tip side edge side 8 of the bulge shaping section 7 may contact, and forms the reactant gas path 14 between a separator 1 and an electrode 12.
[0008] The gold plate layer 9 of a separator 1 carried out and formed the washing process, the parcel-gilding stroke, the washing process, and the desiccation process in this sequence the cleaning process, a washing process, and surface activity chemically-modified degree, without performing substrate plating to the separator material by which press forming was carried out. At a cleaning process, the fats and oils which adhered to the front face of a separator material using the strong-base system degreaser are removed. To a surface activity chemically-modified degree, using an inorganic mixing acid and an organic system inhibitor as a processing agent, while activating the front face of a separator material, it graduates. In a parcel-gilding stroke, parcel plating is carried out to the bulge tip side edge side 8 of the bulge shaping section 7 of a separator material using the sparger method which blows off plating processing liquid from the nozzle which impressed the electrical potential difference to the separator material in the plated section, and forms a partial deposit, using a cyanogen golden potassium solution as plating processing liquid.
[0009] In order to investigate the effect of the gold plate layer 9 exerted on the contact resistance of a separator 1 and the electrodes 12 and 13 of the unit cells 10 and 11, as shown in drawing 3 , the flow resistance at the time of an electron flowing in a separator 17 through an electrode substrate 16 from a separator 15 was measured. Hereafter, it explains in full detail about measurement of flow resistance. As shown in drawing 3 , the electrode substrate 16 which consists of the same component as the electrodes 12 and 13 of the unit cells 10 and 11 is pinched between the separators 15 and separators 17 which consist of the same structure and the same quality of the material as a separator 1. Furthermore, a separator 15 and a separator 17 are pinched with the collecting electrode plates 19 and 20 of a pair linked to a constant current power supply 18. When a fixed current is supplied between a separator 15 and 17, a separator 15 and the potentiometer 21 by which series connection was carried out among 17 detect a separator 15 and the potential difference produced among 17, this potential difference is converted into resistance, and flow resistance is acquired. Under the present circumstances, collecting electrode plates 19 and 20 are grasped with the press plates 24 and 25

through electric insulating plates 22 and 23, the press plates 24 and 25 are pressed with press equipment (not shown), and the planar pressure of predetermined magnitude is applied to the bulge tip side edge sides 26 and 27 of separators 15 and 17.

[0010] The thickness of the gold plate layers 28 and 29 formed in the bulge tip side edge sides 26 and 27 of the separators 15 and 17 under fixed planar pressure at drawing 4 and relation with flow resistance are shown. when flow resistance became small and became smaller than 0.06 micrometers so that from drawing 4 R> 4, and the thickness of the gold plate layers 28 and 29 became thin, it became clear to become flow resistance of about 1 law.

[0011] Relation between the flow resistance at the time of changing the planar pressure applied to the bulge tip side edge sides 26 and 27 of separators 15 and 17 to drawing 5 , and planar pressure (inside of drawing)

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the top view of the separator for fuel cells which is the example of this invention.
[Drawing 2] It is the sectional view showing the contact condition of the above-mentioned separator for fuel cells, and a unit cell.
[Drawing 3] It is drawing showing a means to measure flow resistance.
[Drawing 4] It is the graph which shows the relation between the thickness of a gold plate layer, and flow resistance.
[Drawing 5] It is the graph which shows the relation between planar pressure and flow resistance.
[Description of Notations]
1 Separator for Fuel Cells
8 Bulge Tip Side Edge Side
9 Gold Plate Layer
10 Unit Cell
11 Unit Cell
12 Electrode
13 Electrode
14 Reactant Gas Path

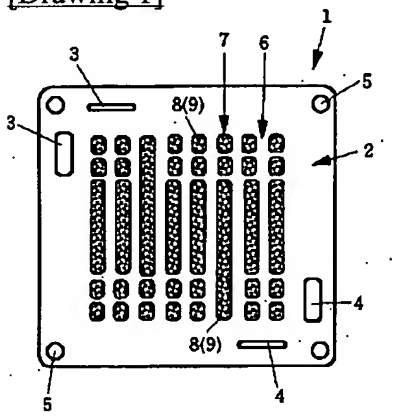
[Translation done.]

* NOTICES *

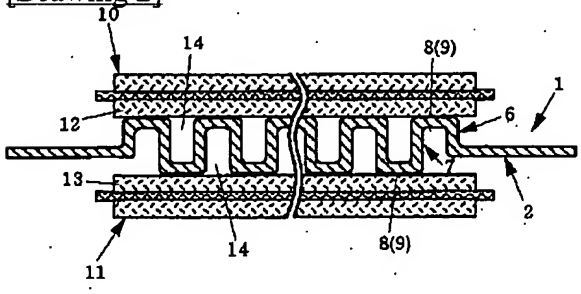
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

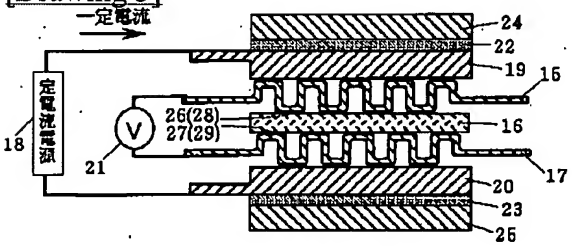
[Drawing 1]



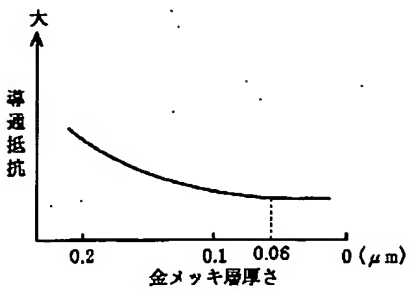
[Drawing 2]



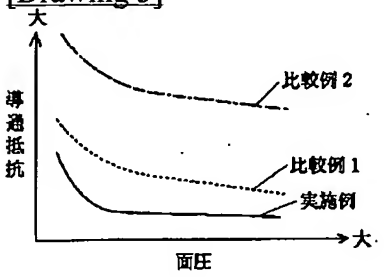
[Drawing 3]



[Drawing 4]



[Drawing 5]



[Translation done.]